CHAPTER 2

CLOTHING AND EQUIPMENT

Section I. CLOTHING

2-1. Introduction

Protective clothing provides firefighters with maximum personal safety which enables them to approach and attack fires and perform rescue operations effectively.

a. For normal fires in buildings or in the open, involving basic, ordinary combustible materials (wood, paper, stored materials, etc.), the protective clothing issued consists of special fireman's bunker coat and trousers with suspenders, plastic helmet, rubber boots, and gloves (fig. 2-1). This clothing, when properly worn, gives reasonable protection to the wearer against normal exposures to heat, flames, water, cold, and physical injury without too much sacrifice of body freedom.

b. For more extreme fire-intensity exposure, such as to flammable liquids, liquid or solid fuels and propellants, chemicals, or explosives encountered in typcial aircraft or missile fires, special protective clothing must be worn in varying combinations with the normal clothing. Such additional clothing consists of special heat reflective coat and trouser covers and protective head, face, and shoulder hoods.

c. All types of protective clothing are intended to be worn, in various combinations, over and in conjunction with normal personal work clothing, depending upon the climatic, work, and fire conditions.

2-2. Normal Protective Clothing

Protective clothing should be put on before leaving the fire station. The following clothing (fig. 2-1) is issued to the firefighter for use in fighting the normal installation fire :

a. Bunker Coat. This is a a/a-length coat of special water repellent flame-retardant duck outer cloth, with water repellent liner and a removable blanket inner lining. Special snap fasteners provide a quick-hitch for putting on the coat. The lining should not be removed except for cleaning.

b. Bunker Trousers. These consist of an overtrouser of duck cloth and liner, similar to the bunker coat. The trouser legs are designed for rapid donning, and to be worn over fireman's boots. Special waist flap and snap fastening are provided to facilitate securing in place. Trousers are generally worn with heavy duty, quick-hitch suspenders. When not being worn, bunker trousers are normally assembled over boots with suspenders arranged to permit donning in a single movement.

c. ***Plastic Helmet.*** This is a special-molded plastic safety helmet with cushioned heat strap to provide fit and prevent impact head injury. A chin strap further secures the helmet in place under arduous work conditions. In some cases, an additional removable inner liner with ear and back-of-neck flaps is provided. This helmet protects against falling debris, contact with obstructions and, to some degree, against water and moderate heat reflection.

d. Boots. Rubber boots designed particularly for firemen's use are hip length with a steel safety toe cap, flexible punctureproof safety insole of overlapping steel plates, and a heavy corrugated non-slip, grease resistant outer sole. It protects the foot against physical injury and may be worn with equal comfort in both hot and cold climates, with variations in socks.

e. Gloves. Standard gloves issued for firemen consist of conventional leather shells of medium-duty type, with thumb and fingers. These gloves may be worn either separately or in various combinations with cotton, wool, or other fabric or rubber- or synthetic coated or impregnated liners or covers, depending upon personal preferences and local conditions. The leather gloves, while not as water-repellent or heat insulative as some types and combinations, are generally preferred,

since they give reasonable protection and are pliable enough not to hinder the performance of fire-fighting tasks, It is good practice to carry an extra pair in the pocket of the turnout coat. Asbestos gloves, unless treated or worn with some combination of water-repellants, are not recommended because they tend to soak up moisture and crate severe internal steaming when exposed to heat.

f. Protective Clothing Maintenance. After use, all types of protective clothing should be checked for damage from cuts, abrasions, burns, or wear, Reflective fabrics of coat and trousers are somewhat more likely to be cut and torn, especially when working close to jagged metal such as damaged aircraft. All items of clothing should be flushed off after use to remove any residues of fuels, extinguishing agents, oils, chemicals, dirt.

Figure 2-1. Normal ***protective clothing.***

Figure 2-2. Special protective clothing.

etc. Persistent dirt or other contamination should be removed by washing with soap or mild detergents, water, and a brush. In come cases, mild solvents may be used for cleaning. Tumbling, scrubbing, or abrasive action would be kept to a minimum, particularly for aluminized reflective fabrics. Clothing should be thoroughly dried after cleaning to prevent molding or rotting. Some protective hood models have a special facepiece glass which may be removed for cleaning or replacement. The glass is removed by unfastening one side of the frame and sliding out the glass.

2-3. Special Protective Clothing

Special protective clothing is used to fight fires of extreme heat, such as oil, missile, and aircraft fires.

a. *Aluminized Covers.* These consist of separate long coat and trouser covers made of special heat-reflective aluminized cloth, the same material of which the hood and gloves in figure 2-2 are made. This material reflects about 90 percent of all radiant heat when clean. The basic fabric is primarily of noncombustible yarns (minimum 84 percent glass fiber and asbestos), and is not readily ignitable if subjected to flashbacks or contact with splashed burning fuel. When worn over normal bunker coats and trousers, with inner liners removed, they absorb and pass on to the body only about 1/10th as much heat as the normal duck bunker clothing. This combined assembly's weight is about 30 percent less than that of the standard bunker clothing with inner liners, and provides greater freedom of movement, more effective operations, and personal safety. Covers may be worn over normal arctic type clothing when on standby in extremely cold climates. Combinations of the coat and trouser covers with other clothing allow the wearer to approach closer to a hot fire and stay longer safely without becoming uncomfortable. By proper prearrangement of the reflective covers over bunker coats and trousers, they can be put on in essentially the same time as bunker clothing alone.

b. Hood. This is a protective plastic skull casement with a sweatband and braces positioned in the upper portion. To this is fastened a swiveled headpiece of thin, hard, lightweight fire-resistant composition material holding a thick safety, fire-resistant, and heat-reflective glass facepiece (fig. 2-2). The hood assembly-from the skull base in the rear and chin level in the front-is draped with a special asbestos and glass fiber heat- and fire-resistive cloth which drops to the shoulders when worn, to protect the otherwise exposed portion of the head, neck, and face. The entire facepiece-body assembly to the hood, including draped fabric, may be swung away from the face to the top of the hood without moving the skull casement from the hood. Before entering the fire or fuel spill area, wearers should check that the fabric drape is completely down and overlapping the coat at the shoulders. Wearers should also vacate the area and remove the hood or lift the facepiece when they notice vapor inside the hood.

c. *Goggles.* If a mask is not worn which will protect the eyes, shatter resistant goggles should be worn when working with power tools or hand tools in pulling, cutting, or striking operations. Goggles must be of good quality to avoid distorted vision.

Section II. FIRE APPARATUS

2-4. Breathing Apparatus

The body can survive a great deal of external damage, but if breathing stops death will result in a short time. By using the proper breathing apparatus the firefighter will be able to enter and work in many fire atmospheres and carry out rescue operations or attack a fire at its seat. A person working with a breathing apparatus must rely to a great extent on his sense of touch. His vision will probably be restricted by smoke and darkness, and to a certain extent by the mask facepiece itself. It is absolutely necessary that a firefighter is thoroughly trained before he attempts to use breathing apparatus on the fire ground. In addition, the apparatus used must be of a suitable type and properly maintained.

a. ***Rules for Using a Breathing Apparatus.*** When working with breathing apparatus, the following rules must be observed.

(1) Use breathing apparatus only when in good health and physical condition.

(2) Do not use breathing apparatus when overexerted. Do not use if you have already suffered from exposure to the unbreathable atmosphere.

(3) Check the operation of the apparatus before entering the fire area.

(4) Always work in pairs. It is important to

have another trained individual present in case of a malfunction in the apparatus.

(5) When possible, stay in contact with a hose line, or use a life line, so escape can be made quickly if necessary. If you should lose contact with a hose line, find a wall and follow it to a window or doorway. To avoid crawling in circles, feel the flooring. Usually floor boards, seams in carpeting, or cracks in tile flooring can be located. Following these will lead you in a straight line to a wall.

(6) Conserve air ; work efficiently and make every movement count.

(7) Thorough training and practice with the type of breathing apparatus to be used is absolutely necessary.

(8) Recognize the limitations of the equipment. Under fire conditions you will have to move slowly as vision is limited. You cannot work as efficiently with breathing apparatus, but you might not work at all without it.

(9) Allow sufficient time to get out of the area in which you are working when the air supply or the oxygen generating capability of the apparatus is used up.

*b. **Breathing Apparatus for General Fire Fighting Use.*** The compressed air, self-contained demand type breathing apparatus is the only type apparatus acceptable for use by Army firefighters. This ***demand*** type compressed air apparatus (fig. 2-3) has a tank of compressed air which is carried by the firefighter and supplies air as he needs it.

c. ***The Compressed Air, Self-Contained, Demand Breathing*** *Apparatus.* This breathing apparatus (fig. 2-3) supplies oxygen in the form of compressed air from a cylinder which is carried by the firefighter. Its name reflects the fact that the air from the cylinder is supplied to the wearer through a demand valve as the wearer inhales. This valve regulates the flow of air proportionate to the supply required and reduces the pressure so that it is supplied to the facepiece at or slightly above normal atmospheric pressure. A variety of this apparatus is designed which maintains a slight positive pressure at all times to insure against leakage. This apparatus is called a ***pressure demand*** breathing apparatus and is similar in operation to the demand apparatus. Operation of the demand valve or regulator is fairly simple. It consists of a large diaphragm which moves in and out with the wearer's inhalation and exhalation. As he inhales, pressure on the diaphragm

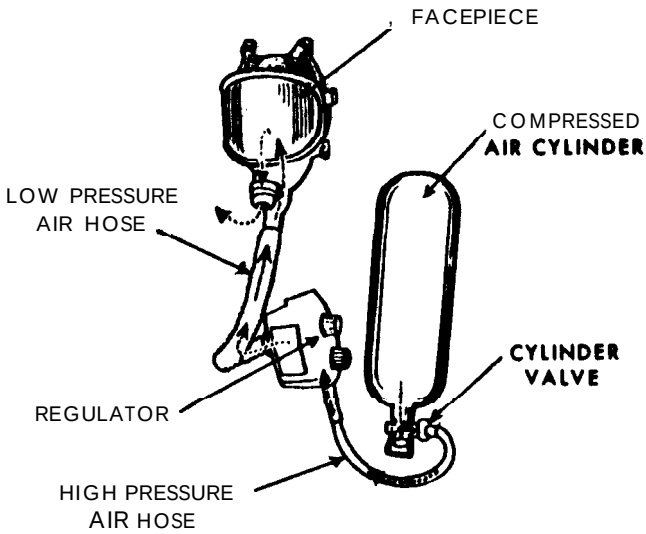

Figure 2-3. The compressed air, self-contained demand type breathing apparatus.

decreases and permits air to flow from the cylinder. The diaphragm permits enough air to flow from the cylinder to provide air in the facepiece at or slightly above normal atmospheric pressure. When inhalation stops, the diaphragm moves inward and stops the flow of air from the cylinder. An exhalation valve on the facepiece releases exhaled air to the outside atmosphere. A speaking diaphragm is also located on the facepiece of most apparatus now being manufactured to permit communication without removing the facepiece. The air cylinder is normally carried on the user's back. A cylinder containing about 40 cubic feet (1 cubic meter) of air at a pressure of about 2000 pounds per square inch (140 kilograms per square centimeter), when full, has become standard in the fire service. It will provide 30 minutes of protection under test conditions. When used on the fire ground, conditions will not be exactly the same as during the tests. The air supply may last less than 30 minutes, possibly as little as 15 minutes. Many makes and models of demand breathing apparatus are in use. In all cases, the detailed instructions provided by the manufacturer should be followed carefully when using, maintaining, and repairing the apparatus. The following are general procedures for using this apparatus.

(1) Inspect the apparatus visually to make sure that all parts appear to be in good operating condition.

(2) Check the cylinder pressure gage to be sure the cylinder is fully charged.

(3) Quickly check all straps to make sure they are fully extended.

(4) Check the demand regulator to be sure the main line valve is fully open and the bypass (red) valve is completely closed. The bypass (red) valve permits air to flow directly to the facepiece without being governed by the operation of a regulator. It is used for escape if the regulator fails to function properly. If it is necessary to use the bypass valve, first open it slightly and close the mainline valve. Next, adjust the bypass valve slowly until just enough air is being supplied to the facepiece to permit breathing while escape is made. If the bypass is opened suddenly excessive air pressure reaching the facepiece may cause it to lift and destroy the seal, leaving you exposed to the contaminated atmosphere until the facepiece can be seated to obtain a proper seal again. If both hands are not needed to escape, as they would 'be in climbing a ladder, it is possible to gain additional escape time by opening and closing the bypass valve as air is needed while you are escaping.

(5) Turn the cylinder valve to the full open position. If the mask is so equipped, set the reserve lever to start.

(6) Insert the left arm through the harness, swing the cylinder assenbly on to the back, and insert the right arm through the harness. It is important to insert the left arm through first, to recude the chance of damaging the regulator by striking it on something as the harness swings around while placing the cylinder on your back (fig. 2-4).

(7) Take up on the shoulder straps so that the cylinder is positioned well up on the back.

(8) Fasten the chest and waist straps.

(9) Grasp the facepiece between the thumbs and forefinger. Place the chin in the lower part of the facepiece and pull the strap harness back over the head. Tighten the straps by pulling *straight back,* not out to the side, first the lower two straps, next the two side straps. Place the hands on the strap harness and push it back toward the neck. Again tighten the lower straps, then the side straps. They should be snug and not too tight. It should not be necessary to tighten the top strap. Check the fit of the facepiece by placing one hand over the end of the breathing tube and inhaling. The facepiece should collapse against the face.

(10) When ready to enter the structure or the contaminated area, connect the breathing tube to the regulator outlet (fig. 2-5).

(11) When the low air pressure warning device (bell, whistle, or resistance to breathing)

Figure 2–4. Putting on the compressed air, *self-contained* demand *breathing apparatus.*

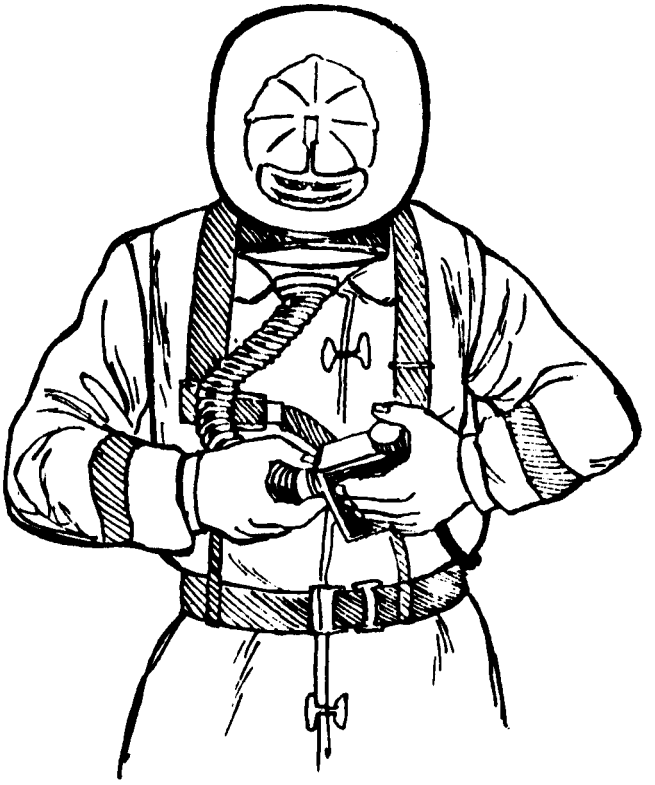

Figure 2–5. Connecting the breathing tube to the regulator *outlet.*

operates, if the apparatus is so equipped, place the reserve lever in the reserve position, and retreat to a safe and breathable atmosphere at once. Some air pressure will remain in the cylinder even after low pressure warning devices have operated and escape has been made. This should be allowed to remain, as a positive pressure in the cylinder will prevent outside air from being forced into the cylinder as the air pressure of the atmosphere changes. This "breathing" would let moisture into the cylinder and could cause rust. Rusting of the cylinder might result in cylinder failure under pressure, or the accumulation of carbon monoxide within the cylinder.

d. ***Breathing Apparatus for Special Situations.*** Rescue work in an extremely confined space, work in a remote area of a large building which cannot be reached or withdrawn from in a short time, or prolonged operations on an elevated platform present situations in which special types of breathing apparatus are useful. One of these special types is the *air line* apparatus. It is similar to the demand breathing apparatus, except that air is supplied through a long small diameter hose from large compressed air cylinders which are usually mounted on the fire truck. Another special type is the *air hose* apparatus. It supplies air through a large diameter hose from a blower or pump located outside the unbreathable atmosphere. Should the blower fail some air can still be obtained through the large diameter hose.

e. ***Limitations of All Breathing Apparatus*** Breathing apparatuses are a means of supplying air to the firefighter, but other dangers still exist. In addition to the time limits in which breathing apparatus functions adequately, the firefighter may become exposed to intense heat or toxic gas. Some of the latter can be absorbed through the skin and produce serious health effects.

2–5. Fire Trucks

Because of the various firefighting problems common to all Army installations, several types of fire apparatus (trucks) are provided. These trucks have pumping capacities ranging from 300 to 750 gallons per minute (gpm) (1135 to 2650 liters per minute). Factors to be considered in determining apparatus requirements are : location, construction, occupancy, property value, existing safeguards, and availability of outside fire protection assistance. Current models of structural firefighting apparatus used by the Army include class 750A, class 500, and classes 530B and 53oc.

a. Class 750A Fire Truck. These trucks are the largest pumping units authorized.

(1) They are, in general, the same type used by municipal fire departments. They are mounted on a 4 x 2 chassis. (The expression "4 x 2" means that the truck has four axle endings and that two of them are power driven.)

(2) Water pressure is provided by a midship-mounted centrifugal type pump, driven by a special gear train or transfer unit from the vehicle engine. The pump on a class 750A pumper can supply four 2½-inch (6,35-centimeter) hose lines at the same time under normal operating conditions. The total pump capacity varies with pressure requirements, as follows : 750 gpm (2839 liters per minute) at 150 pounds (68 kilograms) net pump pressure, 525 gpm (1987 liters per minute) at 200 pounds (91 kilograms) net pump pressure, and 375 gpm (1424 liters per minute) at 250 pounds (113 kilograms) net pump pressure. The booster water tank is mounted in the front end of the hose body and is permanently connected to the intake side of the pump. Its capacity is 150 gallons (568 liters).

(3) The hose body can hold from 1,000 to 2,000 feet (305 to 610 meters) of 2½-inch (6.35-centimeter) double jacketed hose. In addition, the class 750A fire truck carriers 150 feet (46 meters) of l-inch (2.54-centimeter) booster hose permanently attached to the discharge side of the pump. The purpose of the booster tank and the attached l-inch (2.54-centimeter) hose is to enable the firefighting crew to extinguish a small fire in the fastest way possible before it spreads so much as to require a lengthy major layout and loss of considerable time and property. The booster hose may be carried either on a reel or in a compartment basket.

(4) On the class 750A fire truck the linemen and the plugman can ride in the cab behind the driver. Ladders and hard suction hoses are in compartments on top of the side compartments, all tools and accessories are in closed compartments, all pump controls are in closed compartments, and there is a 40-gallon (152-liter) foam tank located forward of the water booster tank.

b. Class 500 ***Fire Truck.*** The class 500 fire truck is commonly used at most installations.

(1) It is similar to the class 750A fire truck except that it is smaller, has less pump capacity, and all tools and equipment are externally mounted. The class 500 fire truck has a 4 x 2 chassis and 90 to 100-horsepower engine. It car-